PROCEEDINGS

58th IWK

Ilmenau Scientific Colloquium

Technische Universität Ilmenau

8 – 12 September 2014

»Shaping the Future by Engineering«

Department of
Mechanical Engineering

TECHNISCHE UNIVERSITÄT
ILMENAU

IMPRESSUM

Editor: The President of Technische Universität Ilmenau
Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c. mult. Peter Scharff

Dean of the Department of Mechanical Engineering
Univ.-Prof. Dr.-Ing. Christian Weber

Marketing Division
Andrea Schneider

Publisher: Universitätsbibliothek Ilmenau
ilmedia
Postfach 10 05 65
98684 Ilmenau

URN: urn:nbn:de:gbv:ilm1-2014iwk:3

URN: urn:nbn:de:gbv:ilm1-2014iwk:3

PREFACE

Dear Conference Participants!

We are delighted to welcome you to Technische Universität Ilmenau for the 58th Ilmenau Scientific Colloquium (58. Ilmenauer Wissenschaftliches Kolloquium, IWK). The IWK looks back on almost 60 years of tradition in exchanging scientific ideas and bridging disciplines.

In 2014, the Ilmenau Scientific Colloquium is again organised by the Department of Mechanical Engineering.

The title of this year's conference:

"Shaping the Future by Engineering"

points out that in our modern world technology and its creation by engineering is probably the most dominant driver in shaping the future of mankind – posing a great responsibility on engineers as the main actors. The Colloquium, complemented by workshops, is characterised by the following topics, but not narrowly limited to them:

- Precision Engineering and Precision Measurement Technology
- Mechatronics, Biomechatronics and Mechanism Technology
- Systems Technology.

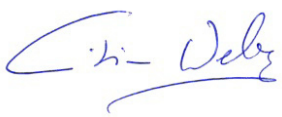
The topics are those facets of Mechanical Engineering in which our own Department strives to excel, as a centre of both research and teaching. They are also part of the dedicated research strategy which Technische Universität Ilmenau as a whole has successfully defined as a strategic guideline. As always in the long series of IWK conferences, we have invited and encouraged contributions both from academia and industry.

We are delighted with the response:

After careful international reviewing, more than 200 contributions remain for presentation, representing 15 contributing countries. The range of subjects certainly reflects the interdisciplinary nature of the conference topics and will bring together industrialists and scientists from a variety of disciplines.

The discussions during the IWK will doubtless be both wide and deep, both exciting and exhaustive, providing the material, we are sure, for further publications in the various respective subject-related journals. No matter whether you are an experienced professional or a novice in mechanical engineering – we are convinced that the 58th Ilmenau Scientific Colloquium will be of benefit to you. Besides a fruitful and interesting professional exchange of views, we wish you an enjoyable stay in the town of Ilmenau and its surroundings. Among other things, the town has close connections to Johann Wolfgang von Goethe who already 200 years ago appreciated its beauty and came back many times, both on business and for pleasure. Perhaps the 58th IWK will inspire you to follow in his footsteps!

Professor Peter Scharff
President of the Technische
Universität Ilmenau



Professor Christian Weber
Dean of the Department of
Mechanical Engineering

URN: urn:nbn:de:gbv:ilm1-2014iwk:3

International Scientific Committee

These Papers were evaluated by the by the members of the *International Scientific Committee* in a peer review process.

Andreasen, Mogens Myrup .....Technical University of Denmak, Denmark
Augsburg, Klaus .....Technische Universität Ilmenau, Germany
Barthelmä, Frank .....The Society for Production Engineering and Development (GFE e.V.), Schmalkalden, Germany
Bergmann, Jean Pierre .....Technische Universität Ilmenau, Germany
Bolotnik, Nikolai N. .....Institute for Problems in Mechanics of the Russian Academy of Sciences, Moscow, Russia
Fan, Kuang-Chao .....National Taiwan University, Taiwan
Fröhlich, Thomas .....Technische Universität Ilmenau, Germany
Gao, Wei.....Tohoku University, Japan
Grünwald, Rainer .....Technische Universität Ilmenau, Germany
Günster, Jens .....BAM Federal Institute for Materials Research and Testing Berlin, Germany
Hausotte, Tino .....Universität Erlangen-Nürnberg, Germany
Heim, Hans-Peter.....Universität Kassel, Germany
Hildebrandt, Jörg .....Bauhaus Universität Weimar, Germany
Hofmann, Dietrich.....Jena, Germany
Holub, Jan .....Czech Technical University Prague, Czech Republic
Jäger, Gerd.....Technische Universität Ilmenau, Germany
Jahn, Simon .....Günter-Köhler-Institut für Füge- und Werkstofftechnik GmbH Jena, Gemany
Jywe, Wenyuh.....National Formosa University, Taiwan
Kaufeld, Michael.....Hochschule Ulm, Germany
Kletzin, Ulf .....Technische Universität Ilmenau, Germany
Koch, Michael .....Technische Universität Ilmenau, Germany
Krüger, Helmut.....c/o ETH Zürich, Switzerland
Kuosmanen, Petri .....Aalto University, Finland
Kurtz, Peter.....Technische Universität Ilmenau, Germany
Längle, Thomas .....Fraunhofer Gesellschaft IOSB Karlsruhe, Germany
Lepikson, Herman Augusto .....Escola Politécnica da Universidade Federal da Bahia, Brazil
Liefeith, Klaus.....Institut für Bioprozess- und Analysenmesstechnik e.V. (iba), Germany
Linß, Gerhard.....Technische Universität Ilmenau, Germany
Manske, Eberhard .....Technische Universität Ilmenau, Germany
Marjanovič, Dorian.....University of Zagreb, Croatia

Moritzer, Elmar.....University of Paderborn, Germany
Muravyov, Sergey.....Tomsk Polytechnic University, Russia
Pavlovic, Nenad D......University Niš, Serbia
Rädlein, Edda.....Technische Universität Ilmenau, Germany
Regtien, Paul.....University of Twente, Netherlands
Rothe, Hendrik.....Helmut-Schmidt-Universität/Universität der Bundeswehr Hamburg, Germany
Sattel, Thomas.....Technische Universität Ilmenau, Germany
Savaidis, Georgios.....Aristotle University Thessaloniki, Greece
Schmitz, Josef.....Universität Bielefeld, Germany
Schwartz, Roman .....Physikalisch-Technische Bundesanstalt Braunschweig, Germany
Sinzinger, Stefan .....Technische Universität Ilmenau, Germany
Sommer, Klaus.....Physikalisch-Technische Bundesanstalt Braunschweig, Germany
Stadnyk, Bogdan I. .....Lviv Polytechnic National University, Ukraine
Ströhla, Tom .....Technische Universität Ilmenau, Germany
Theska, René.....Technische Universität Ilmenau, Germany
Ulrich, Wilhelm .....Carl Zeiss AG, Germany
Wang, Yung-Cheng .....National Yunlin University, Taiwan
Weber, Christian.....Technische Universität Ilmenau, Germany
Weiß, Mathias.....Technische Universität Ilmenau, Germany
Witte, Hartmut .....Technische Universität Ilmenau, Germany
Yacoot, Andrew.....National Physical Laboratory Teddington, United Kingdom
Zentner, Lena.....Technische Universität Ilmenau, Germany
Zhang, Hong-Jun .....China Jiliang University, China
Zimmermann, Klaus .....Technische Universität Ilmenau, Germany

Table of contents

Topic 1: Precision Engineering and Precision Measurement Technology

Session 1.1 Nanopositioning and Nanomeasuring Technology

Session 1.2 Measurement and Sensor Technology

Session 1.3 Precision Engineering and Optics

Session 1.4 Image Processing and Quality Assurance

Topic 2: Mechatronics, Biomechatronics and Mechanism Technology

Session 2.1 Mechatronic Systems

Session 2.2 Assistance Systems

Session 2.3 Mechanism Technology

[2.3.10] Specific curvature behavior of compliant mechanism with hydraulic activation used for medical instruments or implants
Issa, Mirna; Hügl, Silke; Rau, Thomas S.; Majdani, Omid; Zentner, Lena
URN: urn:nbn:de:gbv:ilm1-2014iwk-129:3

[2.3.11] Sensor elements made of conductive silicone rubber for a compliant gripper
Issa, Mirna; Zentner, Lena
URN: urn:nbn:de:gbv:ilm1-2014iwk-130:9

[2.3.12] Compliant shear force sensor
Chaykina, Alexandra; Griebel, Stefan; Zentner, Lena
URN: urn:nbn:de:gbv:ilm1-2014iwk-017:0

[2.3.13] Optimal design of adaptive compliant mechanisms with inherent actuators comparing discrete structures with continuum structures incorporating flexure hinges
Milojević, Andrija; Linß, Sebastian; Zentner, Lena; Pavlović, Nenad T.; Pavlović, Nenad D.; Petrović, Tomislav; Milošević, Miloš; Tomić, Miša
URN: urn:nbn:de:gbv:ilm1-2014iwk-141:4

Topic 3: Systems Technology

Session 3.1 Components, Systems and Processes

Session 3.2 Sustainable Mobility

Session 3.3: Production and Processing Technologies

Workshops

Workshop 1: Living Glass Surfaces

[WS.1.1] Glass corrosion effects from dishwashing and their technical solution
Werner, Dirk
URN: urn:nbn:de:gbv:ilm1-2014iwk-189:9

[WS.1.2] Waschen von Floatglas
Emonds, Michael
URN: urn:nbn:de:gbv:ilm1-2014iwk-157:8

Workshop 2: Virtual Engineering throughout the Product Life-Cycle

[WS.2.1] Human factors in IVE development - a case study for virtual fear of public speaking training
Pöschl, Sandra; Tudor, Ana-Despina; Döring, Nicola
URN: urn:nbn:de:gbv:ilm1-2014iwk-026:0

[WS.2.2] Simulation of acoustical properties of technical systems using a network-based sound-server
Siegel, Antje; Husung, Stephan; Weber, Christian; Albers, Albert; Landes, David; Behrendt, Matthias
URN: urn:nbn:de:gbv:ilm1-2014iwk-067:8

[WS.2.3] Determination of the near-field-acoustics of primary vehicle sound sources in relation to indoor pass-by noise testing for the verification of a virtual acoustic vehicle model
Albers, Albert; Landes, David; Behrendt, Matthias; Weber, Christian; Siegel, Antje; Husung, Stephan
URN: urn:nbn:de:gbv:ilm1-2014iwk-070:2

[WS.2.4] State of the art barriers in validation of digital mock-ups in immersive virtual environments
Wall, Konstantin; Tomaszek-Staude, Wilm; Pöschl, Sandra; Döring, Nicola
URN: urn:nbn:de:gbv:ilm1-2014iwk-206:0

Workshop 3: Design Science and Biomimetics (Bionics) - State and Perspectives

[WS.3.1] Biological structures and technical design - a bio-mimetic approach
Schilling, Cornelius
URN: urn:nbn:de:gbv:ilm1-2014iwk-019:8

[WS.3.2] Design of a phase-shifting double-wheg-module for quadruped robots
Fremerey, Max; Köhring, Sebastian; Nassar, Omar; Schöne, Manuel; Weinmeister, Karl; Becker, Felix; Đorđević, Goran; Witte, Hartmut
URN: urn:nbn:de:gbv:ilm1-2014iwk-037:5

Workshop 4: Thermal issues in dimensional metrology - the EMRP-project T3D

Autorenverzeichnis